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Published

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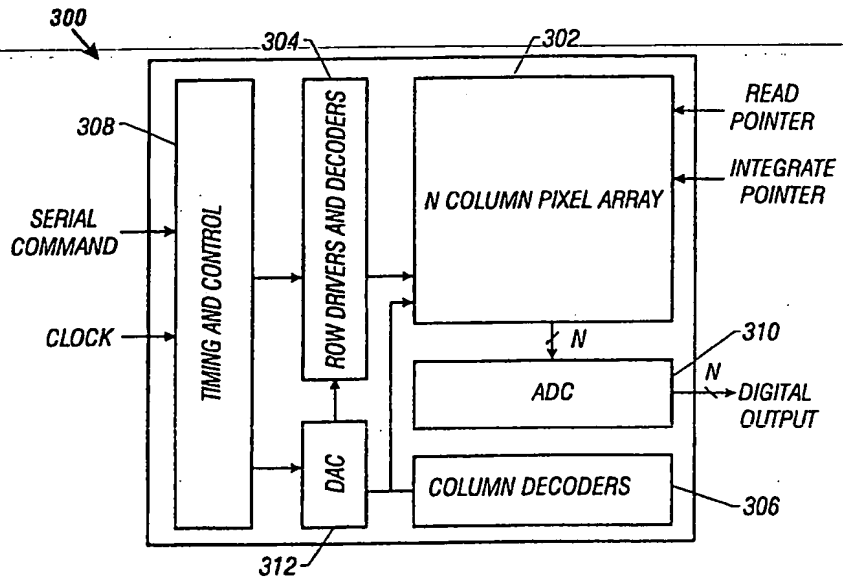
(54) Title: HIGHLY MINIATURIZED, BATTERY OPERATED, DIGITAL WIRELESS CAMERA



(57) Abstract

A miniaturized camera (300) which is programmable and provides low power consumption. An active pixel image sensor (302) used in the highly miniaturized camera provides improved imaging functionality as well as reduced power consumption, extending the possible life time of the camera system. The spread spectrum nature of transmission and reception improves data integrity as well as data security. The ability of the highly miniaturized wireless camera (300) to receive commands as well as transmit image data provides improved functionality and a variable rate of power consumption to be set according to the application and needs of the situation.

FIG. 7 is a block diagram of a base station according to a preferred embodiment.

DETAILED DESCRIPTION

In a preferred embodiment, the camera includes an active pixel sensor ("APS") image sensor of the type described in U.S. Patent No. 5,471,515 to Fossum, et al. or U.S. Patent No. 5,841,126 to Fossum, et al. The APS uses a single power supply of approximately five volts and consumes approximately 20 mW of power. This power consumption is approximately 100 times less than a conventional CCD image sensor. This reduced power consumption extends the system battery lifetime.

The preferred image sensor system is highly miniaturized; all support electronics, including analog to digital converters are included on the imager chip. The camera has a complete serial digital interface which supports half duplex protocols. No support chips are needed, including those for command and data buffering. Additionally, the sensor can be programmed to support a number of imaging modes. These include one chip data reduction operation such as windowing and sub-sampling which can be employed to further reduce transmit power.

By leveraging off of the unique capabilities of the APS and integrating it with a lower-powered digital communication system for a command link and an image link, a digital wireless camera is provided that is more capable and flexible than conventional analog wireless cameras. The command link and its associated protocol allow the camera to be commanded to ultra low power standby mode, receive mode, or full transmit mode. This command link allows the wireless camera to be operated in an intelligent and efficient manner so as to minimize power consumption and extend battery life. For example, the camera can be commanded to lower frame rates, sub-sample an image, or go into sleep mode depending on the application or need. Conventional analog wireless cameras

have no command link and thus, once they are turned on they will operate at maximum power consumption until the power source has expired. The details of these operations are described in co-pending U.S. Patent Application Serial No. 09/162,918, assigned to the assignee of the present disclosure. By contrast, a camera according to the preferred embodiment operates for extended periods of time.

FIG. 1A shows a perspective view of the packaging for one embodiment of a highly miniaturized camera 100. The exterior of the camera 100 is formed from a metallic case 102. A small lens 104 is located on one side of the camera 100. A receiving antenna 106 is inserted into the case 102 of the camera 100 and passes around the exterior of the case 102. The receiving antenna 106 traces a line across an upper edge of each side of the camera 100. The receiving antenna 106 is preferably a 418 megahertz antenna.

A transmitting antenna 108 is positioned on the upper surface of the camera 100. The transmitting antenna 108 is preferably a 2.4216 GHz disc-type antenna.

The camera 100 can also include a power switch 107 for turning the camera 100 on and off and a programming interface 109 for supplying data to and receiving data from the camera 100. As described herein, the programming interface is totally serial and digital.

FIG. 1B shows a block diagram of the positioning of components in the camera 100. The positioning of components in FIG. 1B is a preferred configuration, but alternative configurations are within the scope of the invention. An APS image sensor 110 is located next to the lens 104 so that incoming light is focused on the APS. A battery 112 powers the APS 110 and other elements. The camera 100 also comprises internal components including: power control components 114, receiving components 116, transmitting components 118, digital logic components 120, and clock components 122.

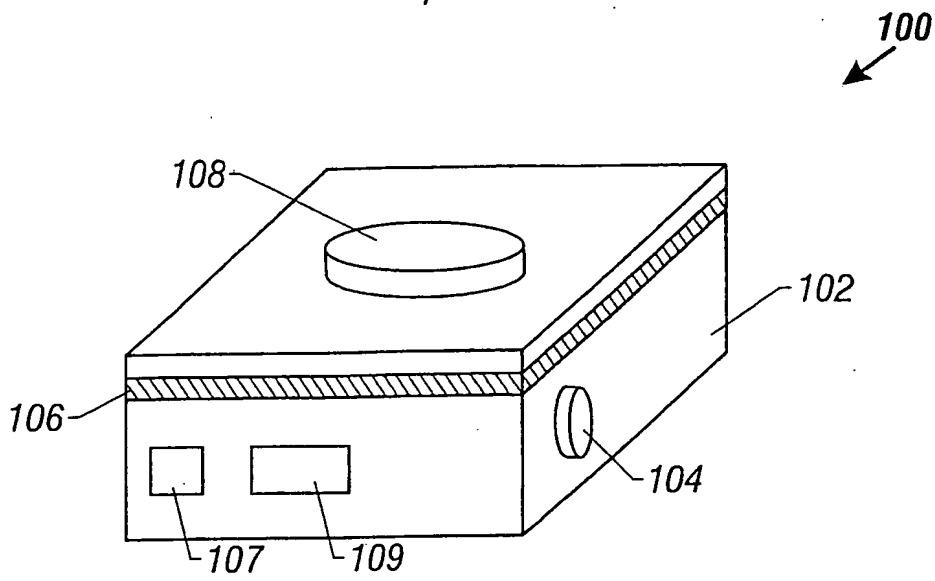

100
108
102
106
104
107
109

FIG. 1A

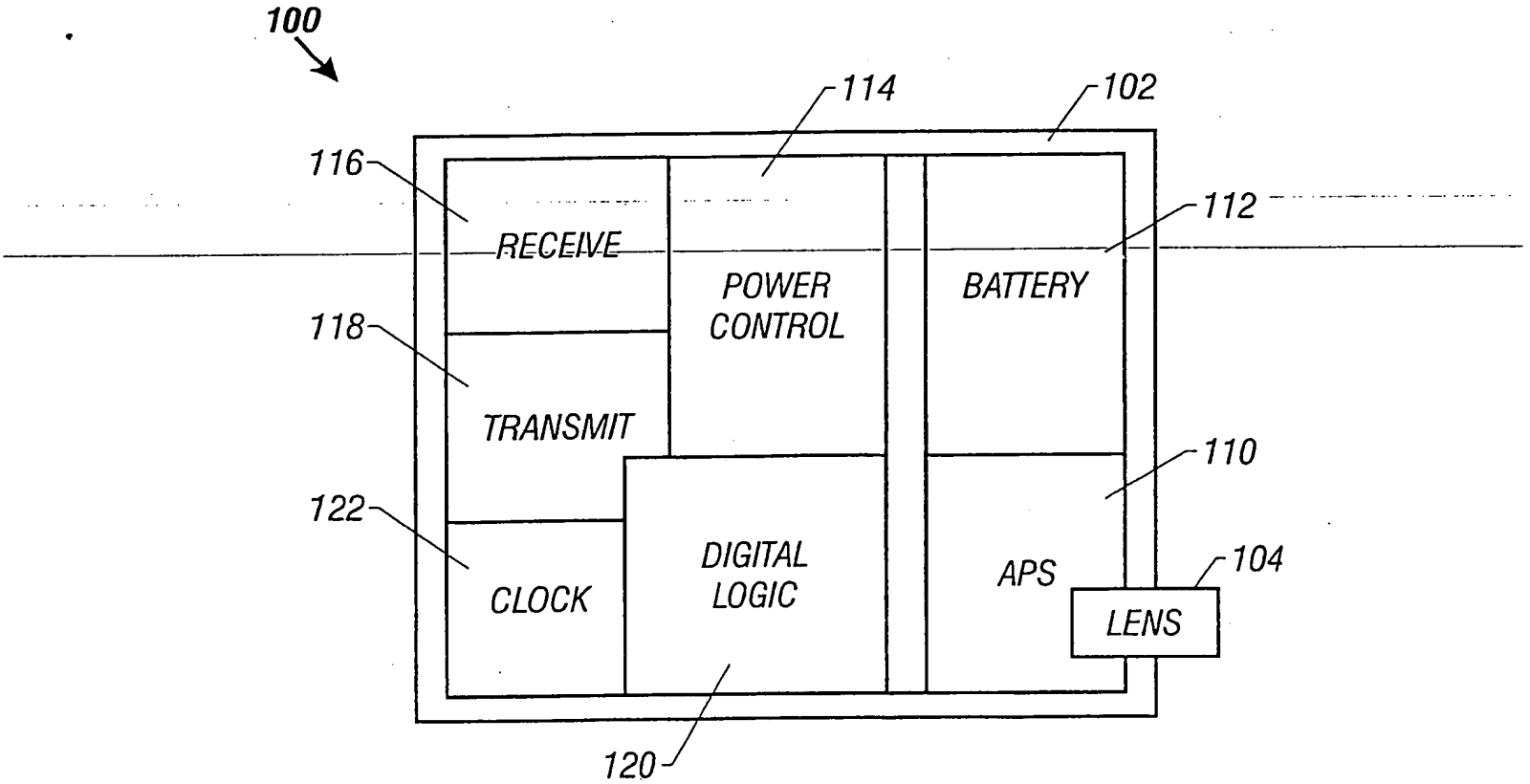

100
114
102
116
112
RECEIVE
POWER CONTROL
BATTERY
118
TRANSMIT
110
122
DIGITAL LOGIC
APS
104
CLOCK
LENS
120

FIG. 1B